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09/581196

534 Rec'd PCT/PTO 19 JUN 2000

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ELECTRODE FOR DISCHARGE LAMPS

The invention relates to an electrode for discharge lamps having a pin at least partially surrounded by a solid body, wherein the electrode body is formed from a wire winding.

Electrodes of the type mentioned in the introduction are used in discharge lamps in order to release or receive electrons during a gas discharge. The electrodes each contain a pin, at the free end of which electrons either emerge from the pin or enter it at this end, wherein the pin is generally partially surrounded by a cooling body in the proximity of its free end, which cooling body is usually formed from a wire wound around the pin. The pin is produced from a high-melting conductive material, usually tungsten and can contain additives of thorium, lanthanum, cerium and yttrium.

It has been shown that both the application of such a cooling body formed from a wound wire on the pin and also a robust attachment of the cooling body to the pin can only be achieved at a high technical cost, wherein the results with respect to a firm attachment of the cooling body to the pin are not satisfactory.

Electrodes for discharge lamps are known from EP 0 209 199 A1 and also from FR 2 087 545 A1, wherein the cooling body or electrode body is formed from a wire winding. These electrodes have the disadvantage, however, that the wire winding is not connected to the pin firmly enough and therefore a robust unit is not formed from the electrode body and the pin.

It is the object of the invention to create an electrode for discharge lamps, wherein the electrode body is firmly connected to the pin and forms a robust unit therewith.

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For an electrode of the type mentioned in the introduction, this object is achieved in that the electrode body is welded to the pin at one or more fixing points by means of laser beams.

Alternatively this object is achieved for an electrode of the type mentioned in the introduction in that the electrode body is welded to the pin at one or more fixing points by means of electron beams.

By means of the feature in which the invention resides, that the electrode body formed from a wire winding is welded to the pin at one or more fixing points by means of laser beams or electron beams, it is achieved in the electrode in accordance with the invention that in addition to the friction force which is achieved by an elastic pretensioning of the wire winding surrounding the pin, a further anchoring of the electrode body to the pin is achieved by directly welding the two components at at least one random position at which these components come into mutual contact. In this way the overall strength by which the electrode body is connected to the pin is increased. Furthermore, by means of the effect of the laser beam on the surface of the pin, a deformation thereof is caused, which results in a local change in radius or enlargement in radius. By reason of this deformation the solid body is prevented from slipping over the pin or from being pushed thereover.

In so doing it has been shown that by reason of the brittleness of the welded materials which occurs during a welding process, a connection of this type can only be achieved by laser beams or electron beams since only with these types of beams is it possible to apply a sufficiently large amount of energy to the materials concerned per unit of time in order to produce a very small, quasi spot weld site between these materials and at the same time to make the pin material brittle only locally.

Preferred embodiments of the invention are the subject of the subordinate claims.

In the case of the electrode in accordance with the invention at least one end of the wire winding, preferably the end of the wire winding lying freely on the outside, is severed by laser

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beams in order to separate it from the remaining winding wire after the winding process. In this way it becomes possible to produce wire windings for electrodes particularly quickly and cost-effectively. In accordance with preferred embodiments this end of the wire winding is melted back as far as the outer diameter of the wire winding so that it does not protrude from the wire winding or only does so to an insignificant degree. In this way a wire winding is created which is homogenous in its outer dimensions and has optimal properties with respect to effectiveness and long service life.

The electrode in accordance with the invention will be explained hereinunder with the aid of a preferred embodiment which is illustrated in the Figures of the drawing in which:

Fig. 1 illustrates a conventional discharge lamp in a transverse cross-sectional view;

Fig. 2 illustrates an electrode for discharge lamps according to the prior art, in a side view,

Fig. 3 illustrates a preferred embodiment of the electrode in accordance with the invention, in a side view.

In the case of the discharge lamp 10 illustrated in Fig.1, two electrodes 11, 11' are disposed inside a silica glass bulb 12 in such a way that in each case one end, which is also designated as electrode pin 13, 13', is welded in the glass bulb 12. The electrodes 11, 11' are disposed opposite each other at opposite ends of the bulb 12. The electrode pins 13, 13' are connected by molybdenum foils 14, 14' to molybdenum pins 15, 15' which are each provided for connection to the power supply The molybdenum foils 14, 14' thus act as power supply elements to the electrode pins 13, 13' inside the glass bulb. The electrodes 11, 11' each also comprise a free electrode end 16, 16' also referred to as a "tip", wherein between the electrode ends 16, 16' an electron exchange can take place in such a way that the respective electrode end emits electrons and the other electrode end forms an input for electrons. The electrodes 11, 11' are each surrounded in the region of their ends 16, 16' by an electrode body or cooling body 17, 17'.

In Fig. 2 a conventional electrode 11 as used in a discharge bulb 12 in accordance with Fig. 1

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is illustrated in a side view. The electrode body or cooling body 17 is formed from a wire wound around the electrode 11, the ends 17a and 17b of which are free. As shown in the Figure, the wire can be wound in two layers in respectively different directions.

In the electrode 11 in accordance with the invention illustrated in Fig. 3, like reference numerals designate like components as in the electrode illustrated in Fig. 2. In contrast to the electrode illustrated in Fig. 2, the electrode illustrated in Fig 3 comprises four fixing points 19, 19', 19" and 19"' at which the wire winding 17 is spot welded to the electrode pin 18. The number of fixing points 19, 19', 19" and 19"' is only given as an example in the illustrated embodiment. It is also possible to envisage a larger or a smaller number of fixing points. In particular if a fixing point is formed with a large volume it is sufficient in terms of the solution of the object forming the basis of the invention if only a single fixing point 19 is provided.

In the case of the electrode in accordance with the invention illustrated in Fig. 3, the ends 17a and 17b of the wire winding 17 are severed from the wire - used for winding the winding 17 - during manufacture by means of laser beams. The ends 17a and 17b of the wire winding 17 are melted back to the respective outer diameter of the wire winding 17 so that, in contrast to the wire ends 17a and 17b of the electrode illustrated in Fig. 2, they do not protrude beyond the wire winding 17.